Investigation of the effect of organic acid water treatment on colonization of broiler chickens with Campylobacter spp during rearing and thinning

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INTRODUCTION

It is estimated that there are approximately 9 million cases of campylobacteriosis per year in EU27 with a total annual cost of 2.4 billion Euros (EFSA, 2011). The organism is a Gram negative, helical, rod shaped bacteria with 1 or more polar flagella (Figure 1). In broilers the highest numbers are in the large intestine, caeca and cloaca. Thinning of broiler flocks has been identified as one route for infection due to contamination on the crates, catching equipment and operatives entering the house. Once infected the organism moves rapidly through the flock due to stress on the birds.

Figure 1:
Scanning electron micrograph of campylobacter bacteria

HYPOTHESIS

If we can provide a "barrier" to the initial contamination of the large intestine this would prevent subsequent infection of the whole flock.

ORGANIC ACID USE

Blends of organic acids have been shown to be effective at controlling the growth of various bacterial species and this reduction is particularly effective at low pH. In vitro work with ACTIVATE® WD Max, a blend of methionine hydroxy analogue, formic and propionic acids, has shown a dose response effect against *Campylobacter jejuni* at pH 4.5 (CCL Report, 2009; Figure 2). In the chicken intestine this effect would be most apparent in the proximal part of the gut where there is a low pH environment providing an enhanced barrier to infection in the distal intestine (Figure 3).

FIGURE 2: Effect in vitro of ACTIVATE WD Max on *Campylobacter jejuni* after 6 hr at pH 4.5

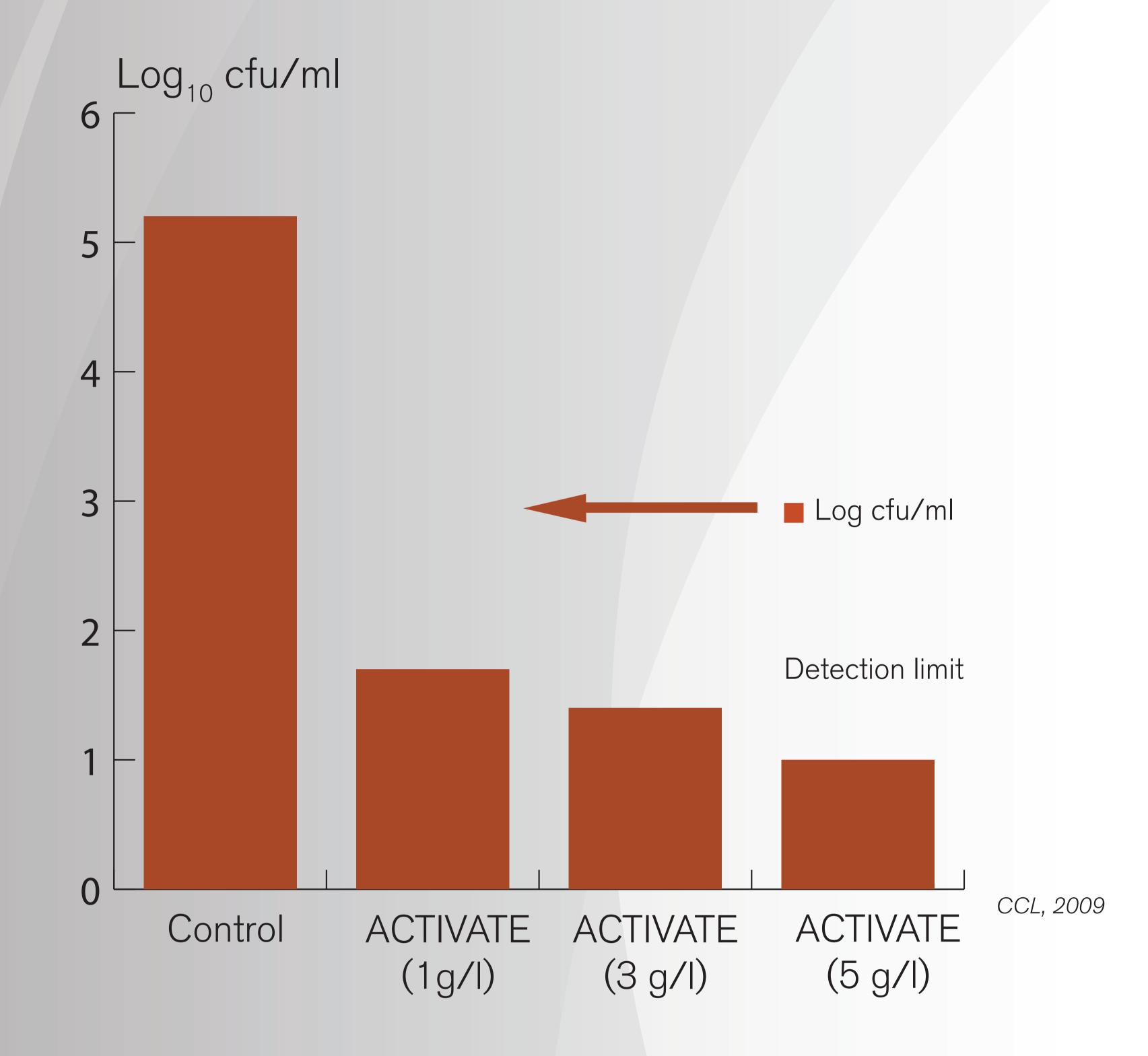
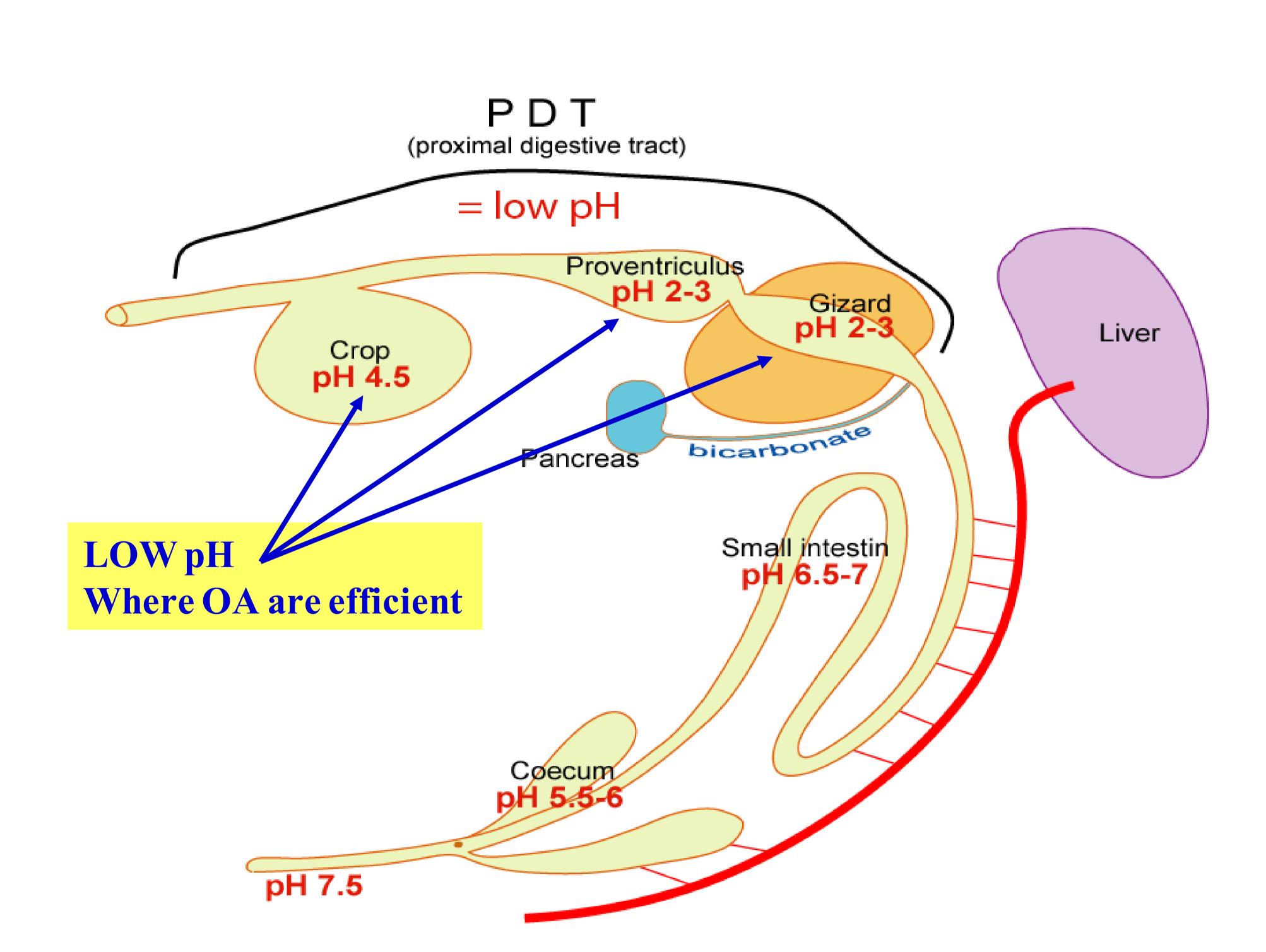


FIGURE 3:
Organic acids increase the effectiveness of the stomach barrier



EXPERIMENTAL DESIGN

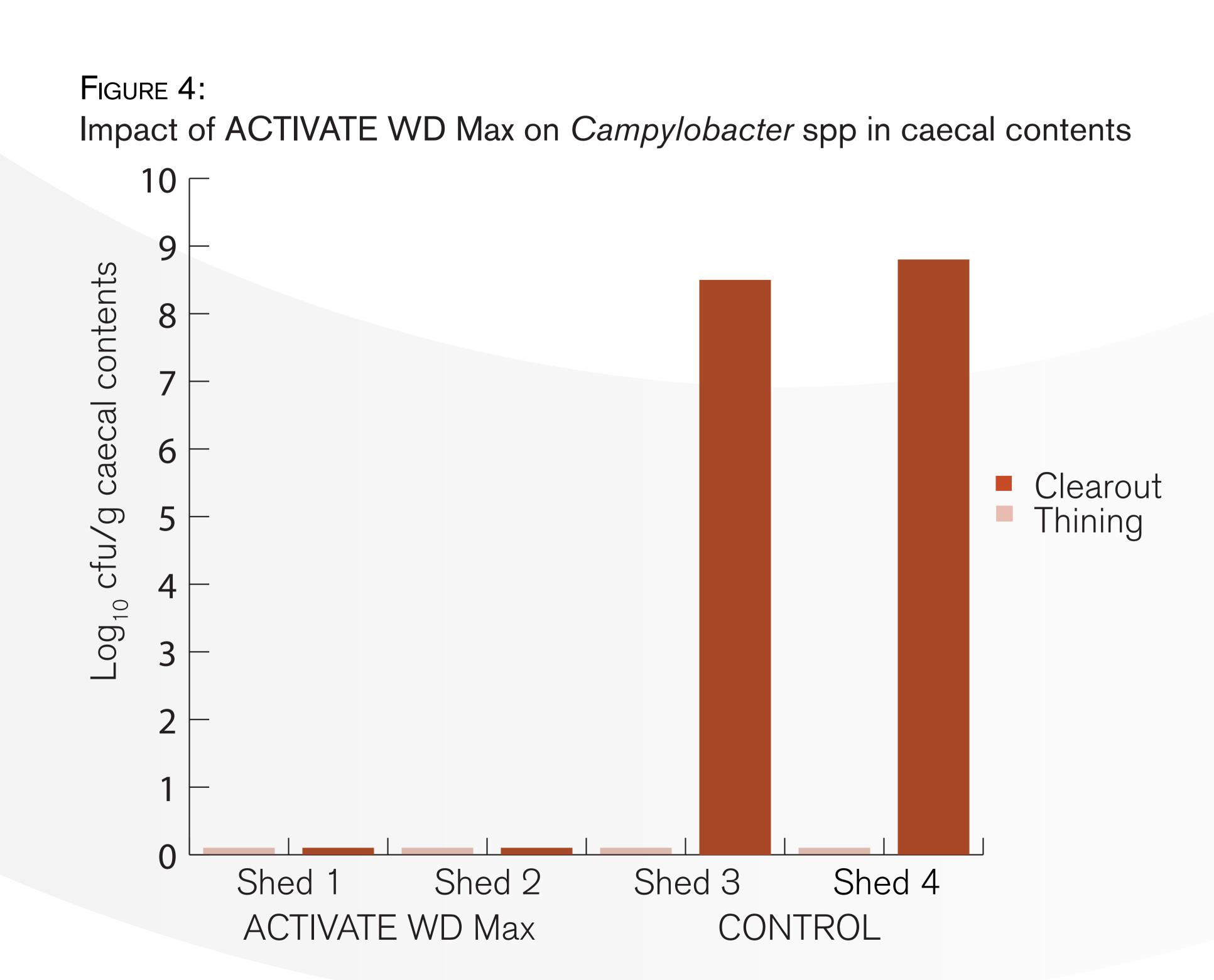
- Commercial unit with 4 identical houses each holding 25,000 birds.
- ACTIVATE WD Max introduced into the water supply of 2 Test houses at 1kg/T (final pH 3.3) at Day 22 and continued until the end of the trial at Day 46. The two other houses acted as Control flocks.
- Campylobacter contamination of the litter in all houses was assessed by the use of 'bootsocks' on Days 22 and 25 before thinning at day 35.
- Caecal contents (10g) were taken from 20 birds from each house at thinning and at Day 46, transported chilled to the laboratory and examined immediately. Serial dilutions of the contents were surface plated onto selective media and incubated in a microaerobic atmosphere at 41.5 degrees for 48h.
- Campylobacter counts (converted to log₁₀ colony forming units per g) in caecal contents in the different sheds were compared using a 2-sample F test for variance and a two tailed t-test.

RESULTS

Water Intake – there was no change in water intake as a result of the inclusion of the organic acid blend in the supply to two rearing sheds. Bootsocks – all bootsocks taken from the four sheds on Days 22 and 25 before thinning were campylobacter negative indicating that at this stage of the production cycle there was no contamination of the litter from faecal excretion of the organism. Caecal Contents Day 35 – campylobacter were not detected (< 10 cfu/g caecal contents) in any of the samples taken from birds in all four houses before thinning.

Caecal Contents Day 46 - No campylobacter were detected (<10 cfu/g caecal contents) in the caecal contents of birds from Sheds 1 and 2 which received the ACTIVATE WD Max in drinking water.Birdsfromsheds3and4(Controlsheds)werecolonizedwithhigh levels of campylobacter in caecal contents (Shed 3: 7.98 to 9.22 log₁₀ cfu/g caecal contents and Shed 4: 7.61 to 9.22 log₁₀ cfu/g caecal contents). See Figure 4.

A two-tailed t-test assuming equal variance found that there was no significant difference (p=0.07) between the mean log count for Shed 3 (8.54) and the mean log count for Shed 4 (8.74).



SUMMARY / CONCLUSIONS

- 1) The broiler producer reported an improvement in litter quality in the two sheds treated with ACTIVATE WD Max in the water supply.
- 2) Prior to thinning no campylobacter were detected in either the litter or the caecal contents of birds sampled from all four sheds.
- 3) Post thinning campylobacter were detected in high numbers in the caecal contents of all the birds sampled from the Control sheds.
- 4) Post thinning campylobacter were not detected in the caecal contents of any of the birds from the sheds which had received ACTIVATE WD Max in the drinking water.

Inclusion of ACTIVATE WD Max in drinking water from Day 22 until clearout may provide an effective way of preventing campylobacter contamination of poultry flocks post thinning.